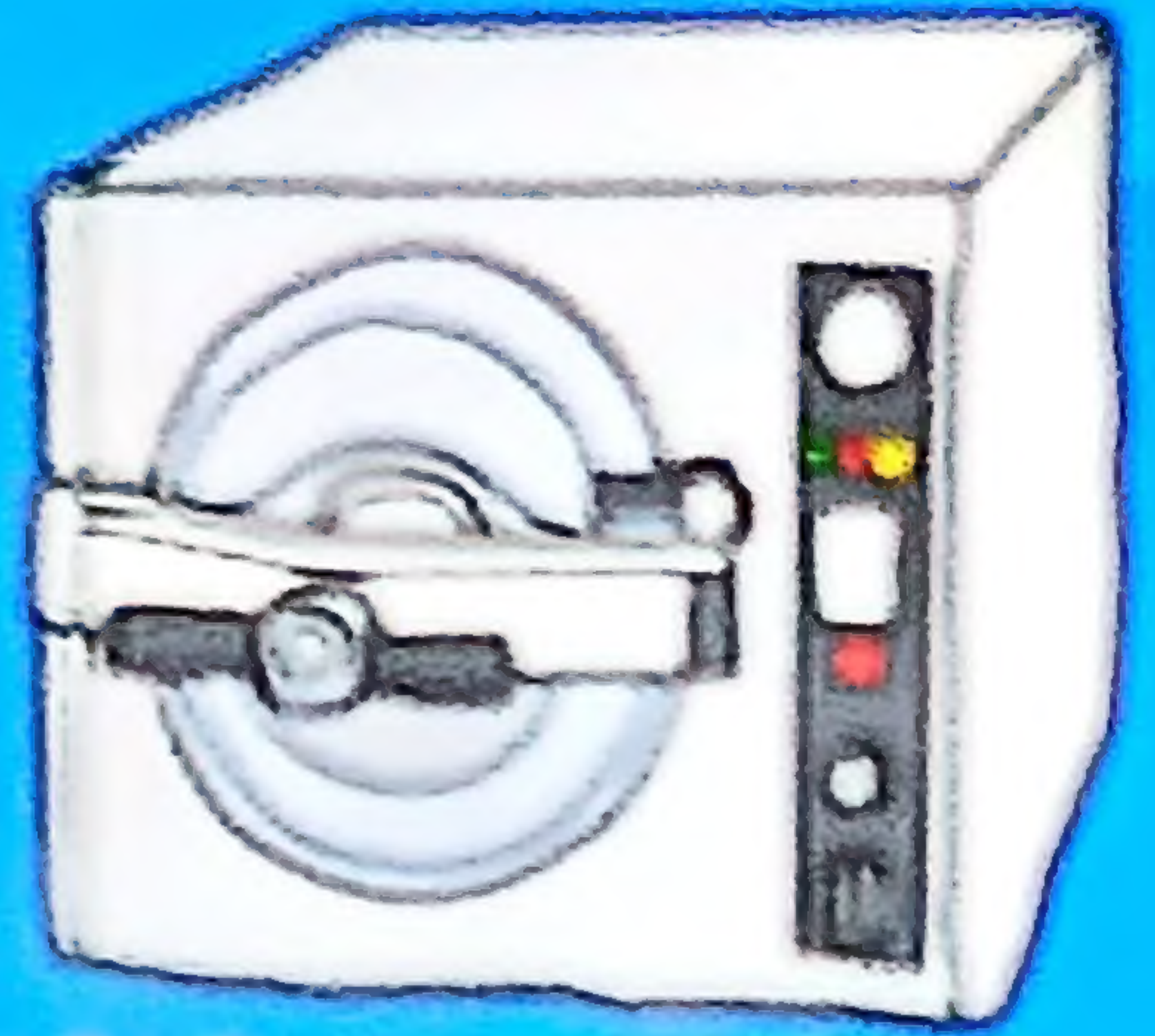


# MICROBIAL CONTROL





## Terminologies



process that destroys all viable  
microbes, including viruses and  
endospores; microbicidal





## Disinfection

Process to destroy vegetative  
pathogens, not endospores; inanimate  
objects





# Disinfection



Unlike sterilization, disinfection does not guarantee that all pathogens are eliminated; indeed, disinfectants alone cannot inhibit endospores or some viruses.





# Terminologies

## Disinfectants

Chemical agents applied to inanimate objects





# Antisepsis

Disinfectants applied directly to  
exposed body surfaces





# Microbial Control

Microbial death - permanent loss of reproductive

Sterilization - process that destroys all viable  
microbes, include viruses,  
endospores; microbicidal



# Terminologies

## Antisepsis



Disinfectants applied directly to  
exposed body surfaces





# Terminologies

## Degerming

Degerming is the removal of microbes from a surface by scrubbing



**REDUCES THE  
NUMBER OF  
MICROBES**



## Terminologies

### Sanitization

Sanitizing reduces the number of germs on objects and surfaces to levels considered safe.







## Factors that Influence the Degree of Killing

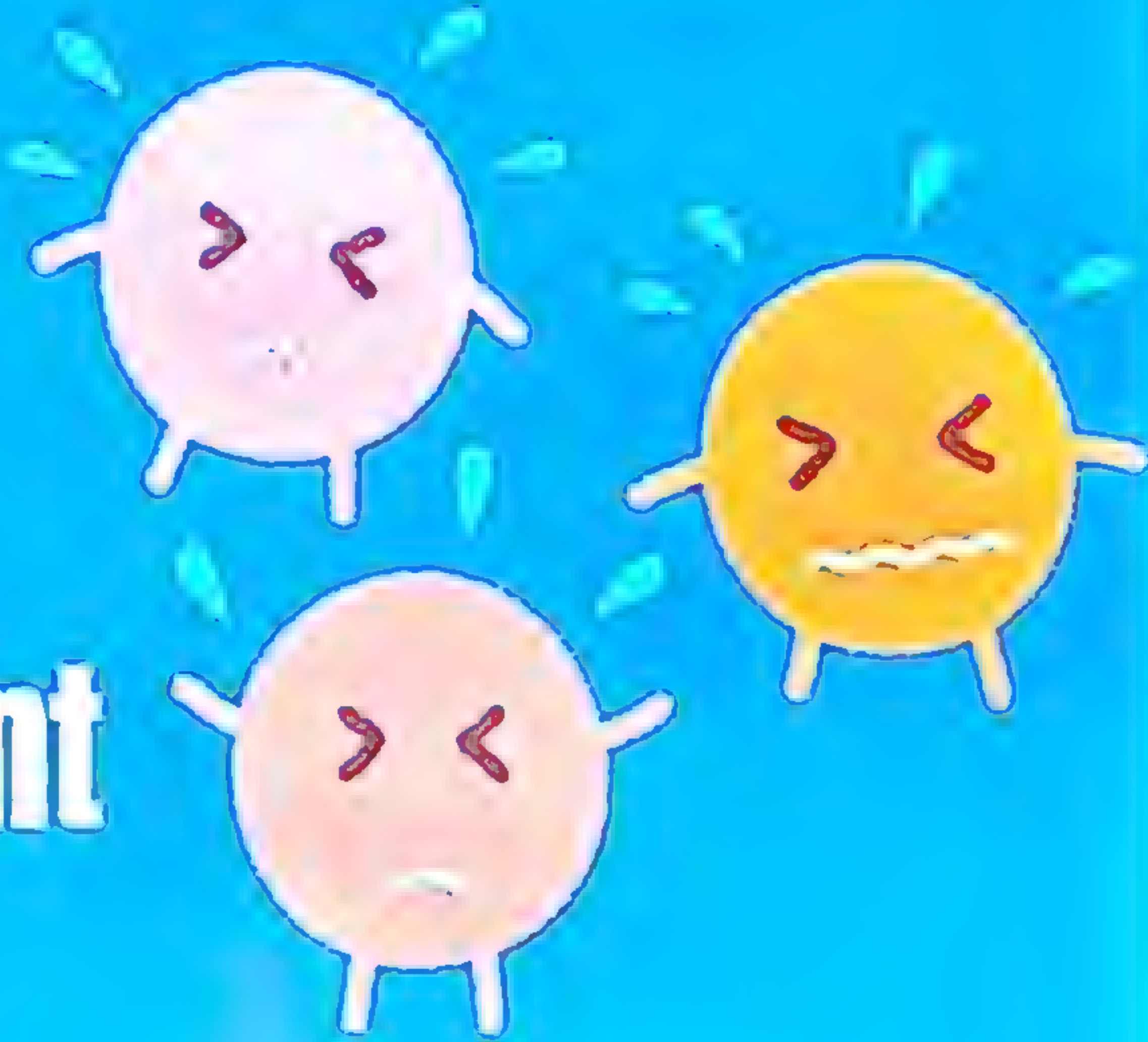
➔ Types of Organisms

➔ Number of Organisms

➔ Concentration of Disinfecting Agent

➔ Presence of Organic Material

➔ Nature of surface to be disinfected





# Factors that Influence the Degree of Killing

→ Contact Time

→ Temperature

→ Biofilms





# Factors that Influence the Degree of Killing

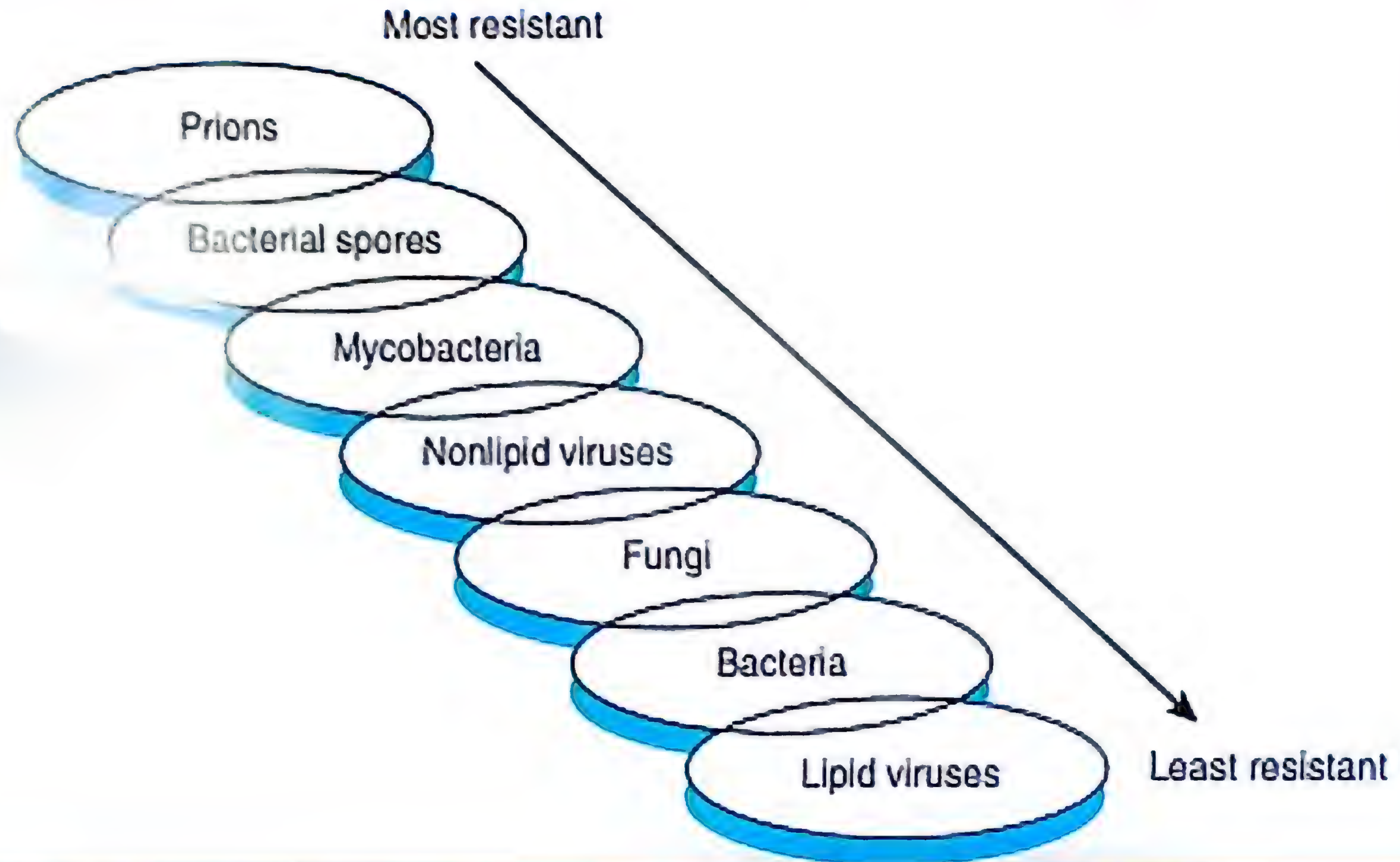
## → Types of Organisms

Biochemical composition of  
Microorganisms

✓ Protective Mechanisms



# Relative Resistance of Microbes



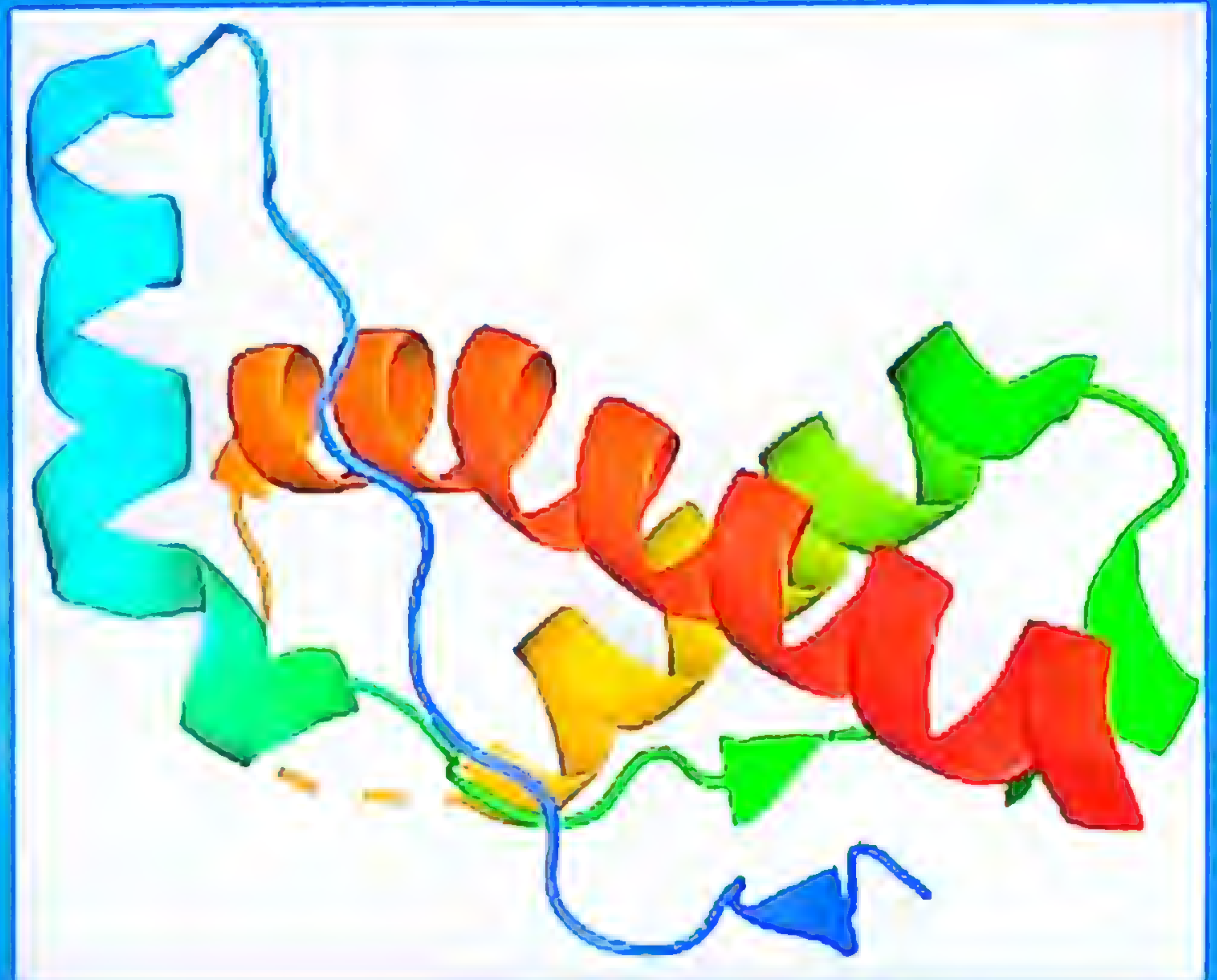


# Factors that Influence the Degree of Killing

## Types of Organisms

Prions

Unfolded pieces of  
protein





## Factors that Influence the Degree of Killing

### → Types of Organisms

#### Prions

Cause a number of  
degenerative disease  
of the nervous system

Creutzfeldt-Jakob disease

Mad cow disease





# Factors that Influence the Degree of Killing



➔ **Number of Organisms**

Microbial Load

▶ **TOTAL NUMBER OF ORGANISMS**

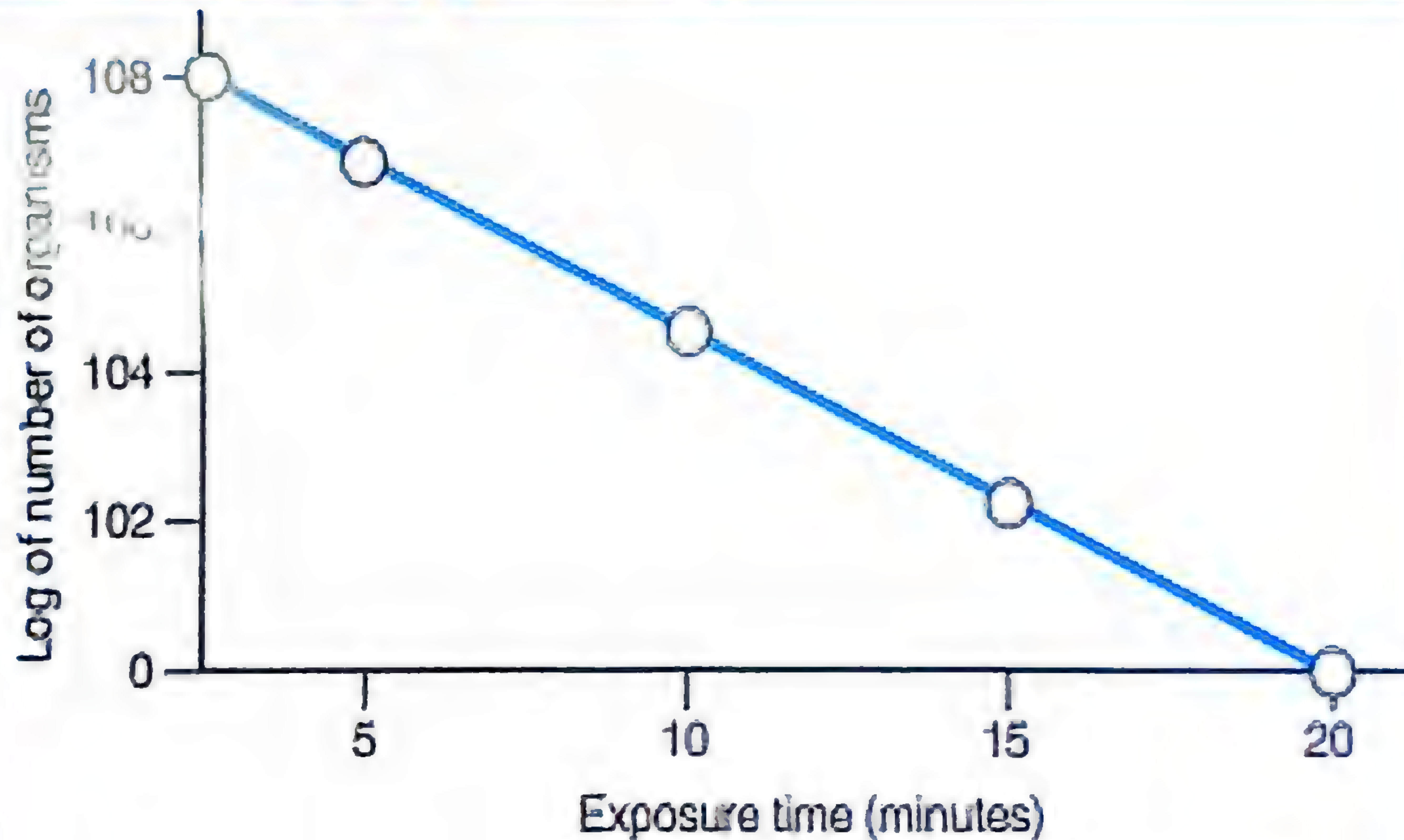
▶ **BIOBURDEN**





# Factors that Influence the Degree of Killing

## Number of Organisms





# Factors that Influence the Degree of Killing

## ➡ Number of Organisms



◆ Generally, the time necessary for killing microorganisms increases in direct proportion to the number of organisms (microbial load).

Higher numbers of Organisms require longer exposure times





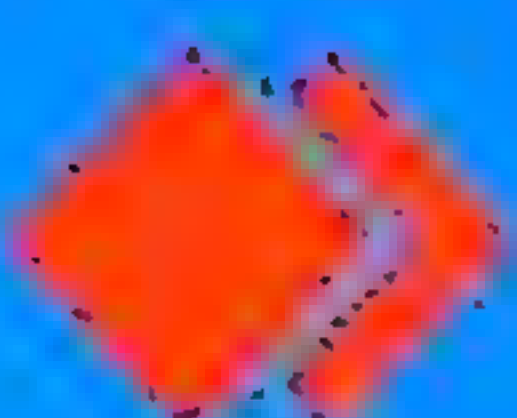
## Factors that Influence the Degree of Killing



### Presence of Organic Material



It inactivates the disinfecting agent



It prevents full contact between object and agent by coating the surface to be treated by coating the surface to be treated





## **Factors that Influence the Degree of Killing**

**→ Nature to Surface to be disinfected**

**Contact Time**

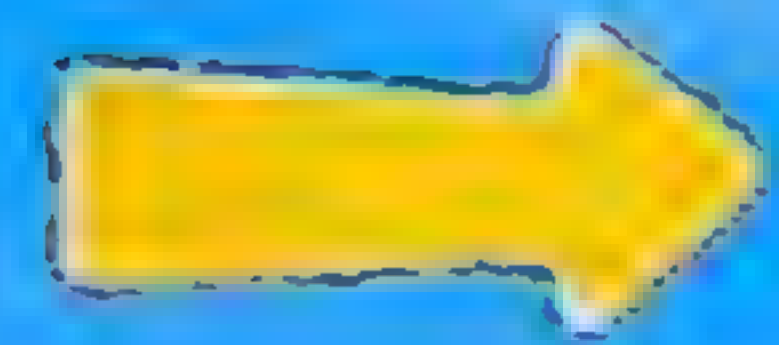
**The amount of time a disinfectant or sterilant is in contact with the object is critical**

- Too little contact time does not allow the agent to work properly**





## **Factors that Influence the Degree of Killing**



### **Contact Time**

- The amount of time that an agent is in contact with an object can also determine whether its is disinfecting or sterilizing the object





## **Factors that Influence the Degree of Killing**



### **Biofilms**

- **Layers of Microorganisms that often have a protective material over them that shields them from outside environmental factors.**





## **Factors that Influence the Degree of Killing**

### **Biofilms**

- In the presence of Biofilm, the concentration of disinfectant may need to be increased, the contact time may need to be increased, or both.





## **Factors that Influence the Degree of Killing**

### **Compatibility of Disinfectants**

**Two is better than one may not be the case for disinfectants**





## **Factors that Influence the Degree of Killing**



### **Type of Water Available**

- The type of water and its concentration in a solution are also important. Hard water may reduce the rate of killing of microorganisms.



# Physical Methods of Sterilization

## → Moist Heat

### Autoclave (Steam under Pressure).

- ✓ MOST EFFECTIVE METHOD OF STERILIZATION.
- ✓ KILLS ALL ORGANISMS INCLUDING VIRUSES AND SPORES.



# Physical Methods of Sterilization

## → Moist Heat

Autoclave (Steam under Pressure).

☒ LIQUID SOLUTIONS AND MEDICAL INSTRUMENTS :  
**121C AT 15 PSI FOR 15 MINUTES**





# Physical Methods of Sterilization



## Moist Heat



Autoclave (Steam under Pressure).



MEDICAL INFECTIOUS WASTES

**132C FOR 30-60 MIN.**





# Physical Methods of Sterilization



## Moist Heat

Autoclave (Steam under Pressure).

 BIOLOGICAL INDICATOR:

*Bacillus stearothermophilus*





# Physical Methods of Sterilization



## Moist Heat

### Intermittent or Discontinuous Sterilization



TYNDALLIZATION: FLOWING STEAM FOR 30  
MINUTES OF 3 SUCCESSIVE DAYS.





# Physical Methods of Sterilization



## Moist Heat



### Fractional or Discontinuous Sterilization



INCUBATION: 75-80°C FOR 2 HOURS ON 3

SUCCESSIVE DAYS





# Physical Methods of Sterilization



## Moist Heat



### Fractional or Discontinuous Sterilization



USED TO STERILIZE MEDIA CONTAINING MILK  
OR SERUM



# Physical Methods of Sterilization

## → Moist Heat

### Fractional or Discontinuous Sterilization



ALTERNATE HEATING (KILLS VEGETATIVE  
CELLS)



# Physical Methods of Sterilization

## → Moist Heat

### Fractional or Discontinuous Sterilization



INCUBATION- SPORES GERMINATE



HEATING (KILLS REMAINING VEGETATIVE  
CELLS)



# Physical Methods of Sterilization

→ **Dry Heat**

Hot air oven



ATTAINED AT 160°C - 180°C

FOR 1 ½ TO 2 HOURS





# Physical Methods of Sterilization

→ **Dry Heat**

**Hot air oven**

USEFUL IN THE

STERILIZATION OF GLASS

WARES







# Physical Methods of Sterilization

 **Dry Heat**

 **Hot air oven**

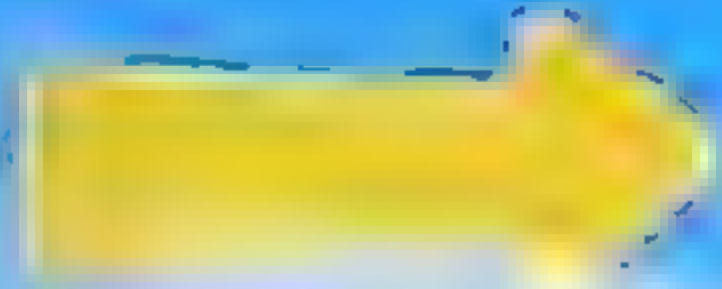
 **CONTROL ORGANISM:**

***Bacillus subtilis* var. *niger***





# Physical Methods of Sterilization



## Dry Heat



## Incineration



For infectious wastes o Attained by burning the materials into ashes at 870C to 890C



# Physical Methods of Sterilization

## → Dry Heat Incinerator







## Physical Methods of Sterilization



### Filtration

Is accomplished through the use of thin membrane filters composed of plastic polymers or cellulose esters containing pores of a certain size



# Physical Methods of Sterilization



## Filtration

liquid is pulled (vacuum) or pushed (pressure) through the filter matrix



# Physical Methods of Sterilization



- 1 min +

00:03



## Filtration

For Carbohydrate solutions, antibiotics,  
vaccines, Radioisotopes

- o For urea broth and sugar fermentation  
broth



# Physical Methods of Sterilization



## Filtration

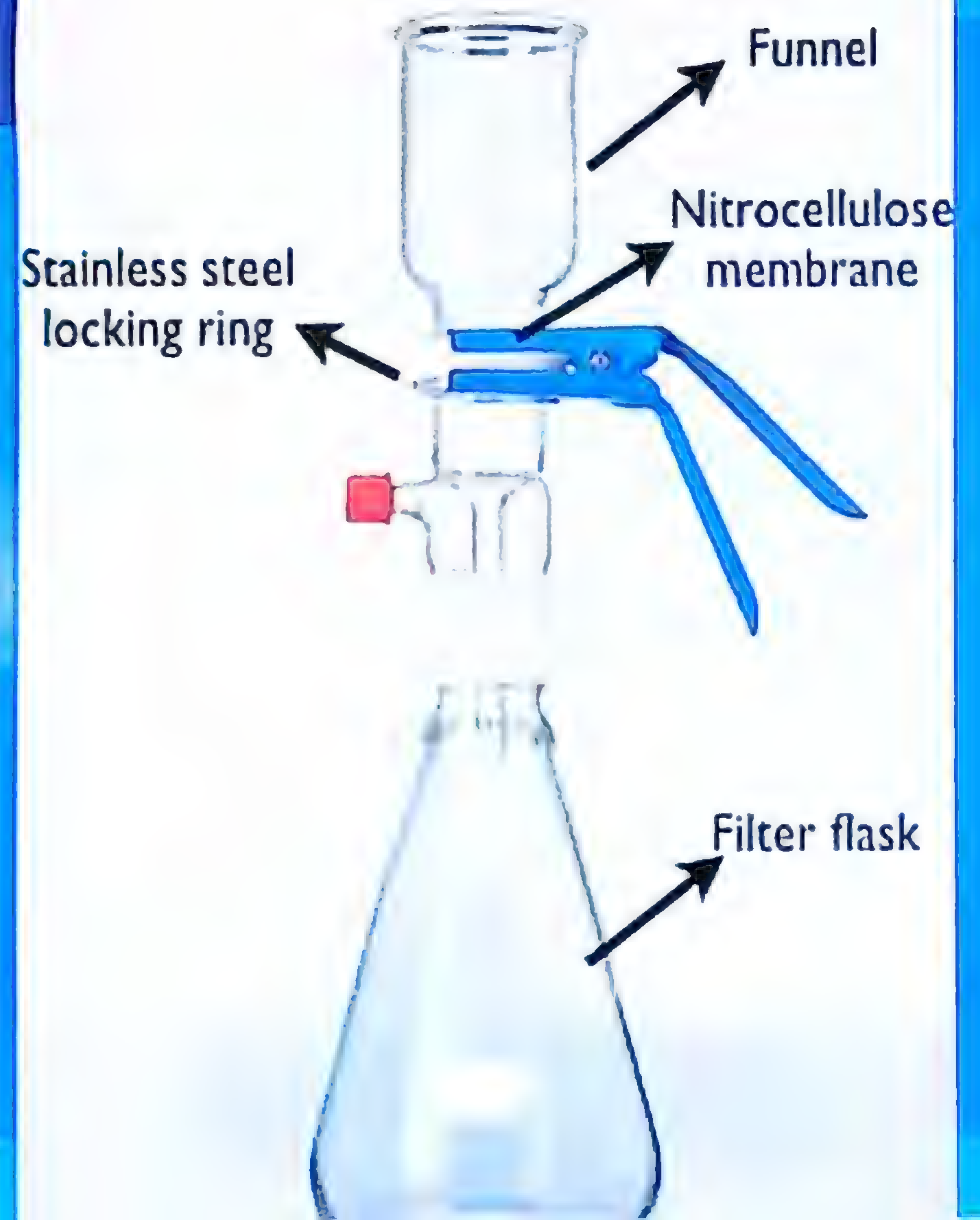
• asbestos filter (Seitz - 98% effective)

• membrane filter [MILLIPORE]  $0.22 \frac{1}{2} \mu\text{m}$  =  
100% bacterial sterility





# Filtration





# Physical Methods of Sterilization



## Filtration

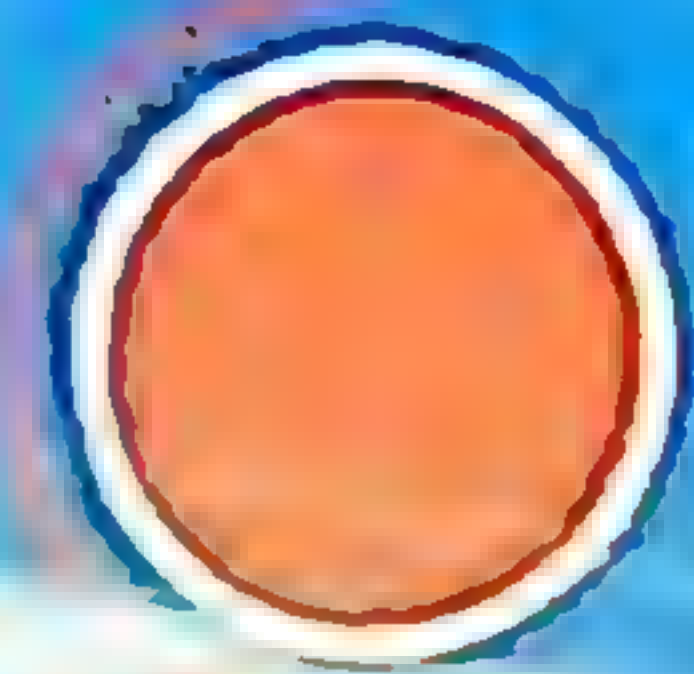
HEPA filters (High-efficiency Particulate Air Filter)

= able to remove microorganisms larger than 0.3µm and are used in laboratory hoods and in rooms of immunocompromised patients





## Physical Methods of Sterilization



### IONIZING RADIATION

In the form of gamma rays or electron beams

- Makes use of short wavelength and high energy





## Physical Methods of Sterilization



### IONIZING RADIATION

used to sterilize plastic syringes, gloves,  
catheters

- Control organism: *Bacillus pumilis*



# Physical Methods of Sterilization



## IONIZING RADIATION

Electromagnetic Spectrum

LOWER ENERGY

HIGHER ENERGY



Non-ionizing radiation

Ionizing radiation



# Physical Methods of Sterilization



## NON IONIZING RADIATION

Makes use of long wavelength low energy UV rays

- It damages DNA by forming thymine and cytosine dimers





# Physical Methods of Sterilization



## NON IONIZING RADIATION

- Mercury lamps for rooms





# Disinfection



## Boiling

Temperature: 100°C for 15 mins.

- Result: Destroys vegetative cell but not the spores





## Disinfection



## Pasteurization

**Result:** Destroys food pathogens for milk and dairy products wherein the total bacterial count is lowered by 95-99%





## Disinfection



## Pasteurization

- Methods:

- Batch/Low Holding temperature: 30 min. at 62-63C
- Flash/High Temperature short time: 15 sec at 72C.